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(71)Applicant : KOKOKU KOUSENSAKU KK
NIPPON STEEL CORP

(72)Inventor : YAZA TORU
KIZUWA TOMIO
SASAKI YOSHIYUKI
KODAMA JUNICHI
OTSU YOSHIHISA
ARAMAKI HIROMI

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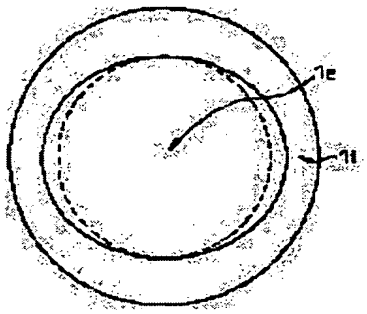
(54) HOT DIP COATED METALLIC WIRE AND ITS PRODUCTION

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a hot dip coated metallic wire which makes it possible to omit a drawing stage and/or annealing stage, eliminates the need for electric power for drawing and fuel for annealing, enables a considerable energy saving effect, contributes to simplification of a production line and a production cost reduction, lessens the generation of harmful gases, etc., by eliminating the need for the drawing electric power and annealing fuel and is friendly to the environment and a process for producing the same.
SOLUTION: The hot dip coated metallic wire having a hot dip coating layer 1f on the circumference of a metallic wire of a core material 1e is higher in the dimensional accuracy of the outside diameter of the hot dip coated metallic wire than the dimensional accuracy of the metallic wire of the core wire. The process for producing the hot dip coated metallic wire consists in subjecting the hot rolled metallic wire to a plating pretreatment in an undrawn state and/or unannealed state, thereby subjecting the metallic wire to hot dip coating.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The hot-dipping metal wire characterized by the dimensional accuracy of the outer diameter of this hot-dipping metal wire being higher than the dimensional accuracy of the metal wire of a core material in the hot-dipping metal wire which has a hot-dipping layer around the metal wire of a core material.
[Claim 2] The hot-dipping metal wire according to claim 1 with which dimensional accuracy of the metal wire of said core material is characterized by being less than **0.2mm.
[Claim 3] The hot-dipping metal wire according to claim 1 or 2 with which dimensional accuracy of the outer diameter of said hot-dipping metal wire is characterized by being less than **0.12mm.
[Claim 4] The manufacture approach of a hot-dipping metal wire given in any 1 term of claim 1 characterized by carrying out plating pretreatment in the state of a non-wire-drawing condition and the condition of not annealing, or either of them, and carrying out hot dipping of the hot rolling metal wire thru/or claim 3.
[Claim 5] The manufacture approach of a hot-dipping metal wire according to claim 4 that dimensional accuracy of said hot rolling metal wire is characterized by being less than **0.2mm.
[Claim 6] The manufacture approach of the hot-dipping metal wire according to claim 4 or 5 characterized by carrying out forced cooling of the molten metal of a metal bar-chart side within the air current of the cooling air which pulls up a metal wire, extracting the molten metal which adhered on the surface of the metal wire to predetermined thickness, and flows to abbreviation parallel just behind that in the travelling direction of a metal wire in the gas iris diaphragm section to which the deoxidization nature gas formed in the hot-dipping tub outlet is supplied.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a hot-dipping metal wire and its manufacture approach.
[0002]
[Description of the Prior Art] In order to raise corrosion resistance, the hot-dipping metal wire which carried out hot dipping of zinc, the zinc-aluminum alloy, etc. is used for the front face of metal wires, such as a low carbon steel wire, in each field from the former. The case of a hot-dipping low carbon steel wire is made into an example, and the production process by the conventional method of this hot-dipping metal wire is explained below using drawing 5 and drawing 6 . First, as shown in drawing 5 , after immersing the hot-rolled low carbon steel wire rod 100 in the pickling tank 101 of a batch type and removing a surface scale, wire drawing is carried out so that it may once become through and predetermined wire-size tolerance at a wire drawing machine 102.
[0003] Next, as shown in drawing 6 , the wire drawing wire rod 103 obtained by this wire drawing is pretreated through the in-line pickling tank 105, a rinse tank 106, the flux tub 107, and a dryer 108, after letting an annealing furnace 104 pass. And after extracting molten metal excessive in the iris diaphragm section 110 after letting the processing wire rod [finishing / pretreatment] 103 pass to the hot-dipping tub 109 and making melting zinc adhere to the perimeter of the processing wire rod 103, it cools in the cooling section 111, molten metal is solidified, and the hot-dipping low carbon steel wire 112 is manufactured.
[0004] (Thus, JIS among the hot-dipping low carbon steel wires manufactured (for example, JIS) G As for 3547phi5.0mm galvanized-iron-wire SWMGS-G7 (two or more coating weight 400 g/m), the specification tolerance of the wire size of a final product is specified to **0.12mm.) Moreover, JISG currently used as feed line material of such [usually] a galvanized iron wire As for the low carbon steel wire rod of 3505 (1996), ****** is specified for wire-size tolerance as 0.64mm or less by **0.4mm. Moreover, JIS G At 3532, it is JIS. G When exceeding [the low carbon steel wire rod which suited 3505] 3.20mm of diameters of a product for dimensional accuracy to wire drawing or the low carbon steel wire cold-rolled and manufactured and exceeding less than **0.08mm and 6.00mm of diameters of a product in the case of 6.00mm or less, it is specified as less than **0.10mm.
[0005] Therefore, JIS G By having galvanized using the low carbon steel wire rod of 3505 as it is, it is difficult to set wire-size tolerance of the last galvanized iron wire to **0.12mm of specification wire-size tolerance, and the annealing processing for returning work hardening accompanying cold working and/or it of wire drawing of a hot rolling metal wire etc. has been considered to be an indispensable thing by the production process of a plating metal wire. While carrying out wire drawing of the low carbon steel wire rod so that it may come near [wire-size tolerance] product specification, after annealing the wire drawing wire rod 103 obtained by this wire drawing through an annealing furnace 104 and returning work hardening by wire drawing, he is trying to pretreat in an above-mentioned example through the in-line pickling tank 101, a rinse tank 106, the flux tub 107, and a dryer 108.

[0006]
[Problem(s) to be Solved by the Invention] However, even if it performs only plating pretreatment to the metal wire rod hot-rolled depending on the application of a galvanization metal wire and galvanizes as it is, what has mechanical properties satisfactory enough, such as tensile strength and elongation-percentage % and a torsion property, can be obtained in many cases. In such a case, therefore, operation of wire drawing and annealing Since the processing speed of the wire rod in a wire-drawing process is large and the processing speed of the wire rod in an annealing process is greatly different in addition to a plating facility, while wire-drawing equipment and an annealing furnace are required, Even if it makes an annealing process and a plating process into one line, there is a problem referred to as a production process being complicated and using the energy of wire-drawing power, an annealing fuel, and many while facility cost starts too much, in order to have to divide a wire-drawing process into another line.
[0007] Then, this invention can skip a wire-drawing process and/or an annealing process in view of such a situation. While wire-drawing power and an annealing fuel can become unnecessary, being able to make the large energy-saving effectiveness possible and being able to aim at simplification of a production line, and reduction of a manufacturing cost It aims at lessening generating of harmful gas etc. and offering an epoch-making hot-dipping metal wire friendly also to an environment, and its manufacture approach according to wire-drawing power and an annealing fuel being unnecessary.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned problem, as a result of inquiring wholeheartedly, as dimensional accuracy exerted on the usability ability of a hot-dipping metal wire, the dimensional accuracy of the outer diameter of a hot-dipping metal wire is important for this invention persons, and the dimensional accuracy of the metal wire of a core material newly carried out the knowledge of not being necessarily high. Furthermore, when enforcing the forced-cooling method special immediately after a hot-dipping tub irrespective of the dimensional accuracy of the metal wire of a core material, the knowledge also of there being also an improvement effect of the roundness by the hot-dipping layer was newly carried out. This invention is completed based on the above-mentioned new knowledge, and the summary is as follows.
(1) The hot-dipping metal wire characterized by the dimensional accuracy of the outer diameter of this hot-dipping metal wire being higher than the dimensional accuracy of the metal wire of a core material in the hot-dipping metal wire which has a hot-dipping layer around the metal wire of a core material.
(2) A hot-dipping metal wire given in the above (1) whose dimensional accuracy of the metal wire of said core material is characterized by being less than **0.2mm.
(3) The above (1) whose dimensional accuracy of the outer diameter of said hot-dipping metal wire is characterized by being less than **0.12mm, or a hot-dipping metal wire given in (2).
(4) The above (1) characterized by carrying out plating pretreatment in the state of a non-wire-drawing condition and the condition of not annealing, or either of them, and carrying out hot dipping of the hot rolling metal wire thru/or the manufacture approach of a hot-dipping metal wire given in any 1 term of (3).
(5) The manufacture approach of a hot-dipping metal wire given in the above (4) whose dimensional accuracy of said hot rolling metal wire is characterized by being less than **0.2mm.
(6) The above (4) characterized by to carry out forced cooling of the molten metal of a metal bar-chart side within the air current of the cooling air which pulls up a metal wire, extracting the molten metal which adhered on the surface of the metal wire to predetermined thickness, and flows to abbreviation parallel just behind that in the travelling direction of a metal wire in the gas iris diaphragm section to which the deoxidization nature gas formed in the hot-dipping tub outlet is supplied, or the manufacture approach of a hot-dipping metal wire given in (5).
[0009] Others, aluminum, copper, etc. those alloys, etc. are mentioned to the metal which can be used for the metal wire of the core material of this invention. [iron / (mild steel special steel)] Moreover, zinc, aluminum, a zinc-aluminum alloy, etc. are mentioned as a metal which can be used for the molten-metal plating of this invention. Drawing 1 is drawing showing typically the

cross-section configuration [redacted]e hot-dipping metal wire concerning t[redacted]vention, and explains the situation that the dimensional accuracy of the outer diameter of a hot-dipping metal wire is higher than the dimensional accuracy of the metal wire of a core material. In order for there to be a correlation in the dimensional accuracy of the metal wire of a core material, and the dimensional accuracy of the outer diameter of a hot-dipping metal wire and to set more dimensional accuracy of the outer diameter of a hot-dipping metal wire to **0.12mm at high degree of accuracy, it is desirable to set [in / for the dimensional accuracy of the metal wire of a core material / manufacture] dimensional accuracy of a hot rolling metal wire to less than **0.2mm. Moreover, although the cooling air used at a forced-air-cooling process although it changes also with various conditions, such as a class of plating metal, linear velocity at the time of plating, coating weight of plating, and a wire size, will not be especially limited if the molten metal adhering to the peripheral surface of a wire rod can be cooled from the perimeter by the equal pressure, its rate-of-flow 10 m/s - 60 m/s is common.

[0010] That is, if the rate of flow is less than 10 m/s, it will cause the lappet omission of an adhesion metal, and when it exceeds 60 m/s, there is a possibility of causing scattering of an adhesion metal. In addition, in a forced-air-cooling process, in order to heighten the cooling effect, water is mixed to air and it may be made to perform Myst cooling. Furthermore, although it changes also with various conditions, such as a class of plating metal, generally [the linear velocity at the time of plating, the coating weight of plating, and a wire size] for the linear velocity at the time of plating, the coating weight of 20-80m a part for /and plating is [100 - 800 g/m2 and a wire size] 2.0-10.0mm.

[0011] Moreover, although not limited, when nitrogen gas, hydrocarbon system gas, an exoergic mold controlled atmosphere, etc. are mentioned and a cost side is taken into consideration especially as deoxidization nature gas, an exoergic mold controlled atmosphere is desirable. An exoergic mold controlled atmosphere is a controlled atmosphere which the mixed gas which mixed town gas or natural gas, and air by excess air ratios fewer than a chemically correct mixture ratio is burned, and is obtained here, and it is desirable to use what absorbed moisture until especially the dew-point became -40 degrees C or less.

[0012]

[Embodiment of the Invention] The gestalt of operation of this invention is explained to it in detail, referring to a drawing to below. Drawing 2 is drawing which makes an example the case of a hot-dipping low carbon steel wire, and explains the gestalt of the operation about the manufacture approach of the hot-dipping metal wire concerning this invention.

[0013] As shown in drawing 2 , after this manufacture approach removes a surface scale by the mechanical descaler 22 which took over with the supply 11 and was prepared between opportunities 21 while it first pulls out precision rolling wire rod (it is hereafter described as "**** material") 1a beforehand hot-rolled by less than **0.2mm wire-size tolerance from a supply 11 and takes it over with the taking over machine 21, it extends the deflection of **** material 1a with a straightening machine 23. And after carrying out surface acid washing with the in-line pickling tank 24 prepared behind the taking over machine 21, a rinse tank 25 washes an acid and it pretreats through the flux tub 26 and a dryer 27 further.

[0014] Next, this pretreated wire rod 1b is made to come into the hot-dipping tub 3 equipped with the gas iris diaphragm section 4, as shown in drawing 2 and drawing 3 . After extracting molten metal by the deoxidization nature gas supplied to the gas iris diaphragm section 4, It cools with the forced-air-cooling equipment 5 and the water cooler 6 in which this non-solidified hot-dipping wire rod 1c was prepared by right above [of the gas iris diaphragm section 4], the metal of the melting condition of the front face of non-solidified hot-dipping wire rod 1c is solidified, and 1d of hot-dipping low carbon steel wires is obtained.

[0015] In addition, the gas iris diaphragm section 4 is supplied in the gas iris diaphragm section 4 from a gas supply line 41 by making into deoxidization nature gas what froze and absorbed moisture until a dew-point becomes -40 degrees C or less through a water-cooled process about the exoergic mold controlled atmosphere which the mixed gas which mixed town gas or natural gas, and air by excess air ratios fewer than a chemically correct mixture ratio is burned, and is obtained, as shown in drawing 3 . Moreover, forced-air-cooling equipment 5 is equipped

with the ventilator 52 connec[redacted][drawing 4] by flask-like the pressur[redacted]om 51 and this upper bed opening so that it might be shown, and while the container liner 53 which non-solidified hot-dipping wire rod 1c covered with the molten-metal layer along with the medial axis passes is installed through the pressure room 51, the application-of-pressure air supply tubing 54 is connected to the side face. Moreover, two or more straightening vanes 55 are formed in upper bed opening of the pressure room 51 between the container liner 53 and the peripheral wall at the radial.

[0016] That is, after the application-of-pressure air supplied in the pressure room 51 from the application-of-pressure air supply tubing 54 is rectified by the straightening vane 55, forced-air-cooling equipment 5 serves as an air current along the travelling direction of non-solidified hot-dipping wire rod 1c which moves through a ventilator 52 from a container liner 53, and is sent in in a ventilator 52.

[0017] On the other hand, a water cooler 6 pours water from the both sides of non-solidified hot-dipping wire rod 1c, cools further the molten-metal layer which air cooling was compulsorily carried out and was cooled to near the congealing point, and is made to solidify it thoroughly with forced-air-cooling equipment 5.

[0018] The manufacture approach of this hot-dipping low carbon steel wire by using **** material 1a by which precision strip processing was beforehand carried out to less than **0.2mm wire-size tolerance as feed line material as mentioned above Since pretreated wire rod 1b is obtained and it was made to perform hot dipping to this pretreated wire rod 1b, without passing through a wire-drawing process and an annealing process While wire-drawing equipment and annealing equipment become unnecessary and being able to reduce facility cost, wire-drawing power and an annealing fuel become unnecessary, and energy cost can be reduced. And the problem of the environmental pollution by the waste gas of the fuel used for a generation of electrical energy of wire-drawing power or heating at the time of annealing is also lost.

[0019] Moreover, forced-air-cooling equipment 5 is formed between the gas iris diaphragm section 4 and a water cooler 6. Since forced cooling of the non-solidified hot-dipping wire rod 1c to which the molten metal of this specified quantity adhered is carried out by forced-air-cooling equipment 5 immediately after the molten metal which adhered to the front face of pretreated wire rod 1b in the hot-dipping tub 3 is extracted to an amount predetermined in the gas iris diaphragm section 4 Without adhering molten metal hanging down and falling, where predetermined coating weight is secured, it moves till the place of a water cooler 6.

[0020] And with forced-cooling equipment 5, since the molten metal adhering to the front face of non-solidified hot-dipping wire rod 1c passes along the inside of the air current of cooling air parallel to the travelling direction of non-solidified hot-dipping wire rod 1c by the ventilator 52, air cooling is carried out, an equal pressure being added from a perimeter. That is, ****** of a product is improved by being cooled to near the congealing point, without molten metal's maintaining an abbreviation perfect circle condition, and having an appearance disturbed by the surface tension. Therefore, even if pretreatment settled wire rod 1b is the wire-size tolerance within **0.2mm, 1d of hot-dipping low carbon steel wires by which the wire-size tolerance of a product was covered with less than **0.12mm in the hot-dipping layer of the regular amount of plating can be obtained to accuracy.

[0021] The hot-dipping metal wire concerning this invention and its manufacture approach are not limited to the gestalt of the above-mentioned operation. For example, with the gestalt of the above-mentioned operation, although a wire-drawing process and an annealing process were not performed at all, annealing performs neither light wire drawing which is unnecessary extent, nor wire drawing, but may be made to perform only annealing if needed.

[0022] Moreover, although gas iris diaphragm equipment was used for the iris diaphragm section with the gestalt of the above-mentioned operation, it is clear that it is not what this invention extracts and limits a means to this.

[0023]

[Example] Below, the example of this invention is explained in more detail.

[0024] (Example) The 5.0mm10% aluminum-zinc alloy plating low carbon steel wire was manufactured by the same manufacture approach as the gestalt of the above-mentioned

implementation using the *** [redacted]aterial of lot No.1-7, respectively. And [redacted]ing coating weight was measured with the maximum wire size of the upper bed section of each **** material and the obtained plating low carbon steel wire, and the soffit section, the minimum wire size, and the average wire size, and the result was shown in a table 1.

[0025]

[A table 1]

線材 No.		精圧線材径（mm）			製品径 （偏径差 5.0±0.12mm）			付着量
		X	MIN.	MAX.	X	MIN.	MAX.	g／m²
1	上 下 $\bar{X}$ R	4.940 4.975 4.958 0.22	4.83 4.92	5.05 5.03	 5.04 0.08	5.00	5.08	440
2	上 下 $\bar{X}$ R	4.905 4.98 4.943 0.23	4.80 4.93	5.03 5.01	 5.05 0.08	5.01	5.09	410
3	上 下 $\bar{X}$ R	4.97 4.935 4.953 0.19	4.92 4.84	5.02 5.03	 5.01 0.14	4.94	5.08	412
4	上 下 $\bar{X}$ R	4.915 4.93 4.92 0.39	4.72 4.83	5.11 5.03	 5.03 0.12	4.97	5.09	421
5	上 下 $\bar{X}$ R	4.925 4.975 4.95 0.21	4.82 4.92	5.03 5.03	 5.04 0.08	5.00	5.08	435
6	上 下 $\bar{X}$ R	4.95 4.945 4.948 0.16	4.87 4.88	5.03 5.01	 5.05 0.08	5.01	5.09	452
7	上 下 $\bar{X}$ R	4.93 4.975 4.953 0.20	4.83 4.95	5.03 5.00	 5.015 0.07	4.98	5.05	442
X	$\bar{X}$ R	4.946 0.229			5.034 0.093			

[0026] It turns out that ****** R of a product was halved from the above-mentioned table 1 with 0.093 to ****** R of feed line material having been 0.23, and the wire-size tolerance of product specification can be satisfied. That is, according to the manufacture approach of this invention, it turns out well that it is obtained without the thick-galvanized plating low carbon steel wire of the stable wire size performing wire drawing and annealing.

[0027]

[Effect of the Invention] Since the hot-dipping low carbon steel wire concerning this invention and its manufacture approach are constituted as mentioned above, they can skip a wire-drawing process and/or an annealing process, and can aim at simplification of a production line, and reduction of a manufacturing cost.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a hot-dipping metal wire and its manufacture approach.
[0002]
[Description of the Prior Art] In order to raise corrosion resistance, the hot-dipping metal wire which carried out hot dipping of zinc, the zinc-aluminum alloy, etc. is used for the front face of metal wires, such as a low carbon steel wire, in each field from the former. The case of a hot-dipping low carbon steel wire is made into an example, and the production process by the conventional method of this hot-dipping metal wire is explained below using drawing 5 and drawing 6 . First, as shown in drawing 5 , after immersing the hot-rolled low carbon steel wire rod 100 in the pickling tank 101 of a batch type and removing a surface scale, wire drawing is carried out so that it may once become through and predetermined wire-size tolerance at a wire drawing machine 102.
[0003] Next, as shown in drawing 6 , the wire drawing wire rod 103 obtained by this wire drawing is pretreated through the in-line pickling tank 105, a rinse tank 106, the flux tub 107, and a dryer 108, after letting an annealing furnace 104 pass. And after extracting molten metal excessive in the iris diaphragm section 110 after letting the processing wire rod [finishing / pretreatment] 103 pass to the hot-dipping tub 109 and making melting zinc adhere to the perimeter of the processing wire rod 103, it cools in the cooling section 111, molten metal is solidified, and the hot-dipping low carbon steel wire 112 is manufactured.
[0004] (Thus, JIS among the hot-dipping low carbon steel wires manufactured (for example, JIS) G As for 3547phi5.0mm galvanized-iron-wire SWMGS-G7 (two or more coating weight 400 g/m), the specification tolerance of the wire size of a final product is specified to **0.12mm.) Moreover, JISG currently used as feed line material of such [usually] a galvanized iron wire As for the low carbon steel wire rod of 3505 (1996), ****** is specified for wire-size tolerance as 0.64mm or less by **0.4mm. Moreover, JIS G At 3532, it is JIS. G When exceeding [the low carbon steel wire rod which suited 3505] 3.20mm of diameters of a product for dimensional accuracy to wire drawing or the low carbon steel wire cold-rolled and manufactured and exceeding less than **0.08mm and 6.00mm of diameters of a product in the case of 6.00mm or less, it is specified as less than **0.10mm.
[0005] Therefore, JIS G By having galvanized using the low carbon steel wire rod of 3505 as it is, it is difficult to set wire-size tolerance of the last galvanized iron wire to **0.12mm of specification wire-size tolerance, and the annealing processing for returning work hardening accompanying cold working and/or it of wire drawing of a hot rolling metal wire etc. has been considered to be an indispensable thing by the production process of a plating metal wire. While carrying out wire drawing of the low carbon steel wire rod so that it may come near [wire-size tolerance] product specification, after annealing the wire drawing wire rod 103 obtained by this wire drawing through an annealing furnace 104 and returning work hardening by wire drawing, he is trying to pretreat in an above-mentioned example through the in-line pickling tank 101, a rinse tank 106, the flux tub 107, and a dryer 108.

[0006]
[Problem(s) to be Solved by the Invention] However, even if it performs only plating pretreatment to the metal wire rod hot-rolled depending on the application of a galvanization metal wire and galvanizes as it is, what has mechanical properties satisfactory enough, such as tensile strength and elongation-percentage % and a torsion property, can be obtained in many cases. In such a case, therefore, operation of wire drawing and annealing Since the processing speed of the wire rod in a wire-drawing process is large and the processing speed of the wire rod in an annealing process is greatly different in addition to a plating facility, while wire-drawing equipment and an annealing furnace are required, Even if it makes an annealing process and a plating process into one line, there is a problem referred to as a production process being complicated and using the energy of wire-drawing power, an annealing fuel, and many while facility cost starts too much, in order to have to divide a wire-drawing process into another line.
[0007] Then, this invention can skip a wire-drawing process and/or an annealing process in view of such a situation. While wire-drawing power and an annealing fuel can become unnecessary, being able to make the large energy-saving effectiveness possible and being able to aim at simplification of a production line, and reduction of a manufacturing cost It aims at lessening generating of harmful gas etc. and offering an epoch-making hot-dipping metal wire friendly also to an environment, and its manufacture approach according to wire-drawing power and an annealing fuel being unnecessary.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned problem, as a result of inquiring wholeheartedly, as dimensional accuracy exerted on the usability ability of a hot-dipping metal wire, the dimensional accuracy of the outer diameter of a hot-dipping metal wire is important for this invention persons, and the dimensional accuracy of the metal wire of a core material newly carried out the knowledge of not being necessarily high. Furthermore, when enforcing the forced-cooling method special immediately after a hot-dipping tub irrespective of the dimensional accuracy of the metal wire of a core material, the knowledge also of there being also an improvement effect of the roundness by the hot-dipping layer was newly carried out. This invention is completed based on the above-mentioned new knowledge, and the summary is as follows.
(1) The hot-dipping metal wire characterized by the dimensional accuracy of the outer diameter of this hot-dipping metal wire being higher than the dimensional accuracy of the metal wire of a core material in the hot-dipping metal wire which has a hot-dipping layer around the metal wire of a core material.
(2) A hot-dipping metal wire given in the above (1) whose dimensional accuracy of the metal wire of said core material is characterized by being less than **0.2mm.
(3) The above (1) whose dimensional accuracy of the outer diameter of said hot-dipping metal wire is characterized by being less than **0.12mm, or a hot-dipping metal wire given in (2).
(4) The above (1) characterized by carrying out plating pretreatment in the state of a non-wire-drawing condition and the condition of not annealing, or either of them, and carrying out hot dipping of the hot rolling metal wire thru/or the manufacture approach of a hot-dipping metal wire given in any 1 term of (3).
(5) The manufacture approach of a hot-dipping metal wire given in the above (4) whose dimensional accuracy of said hot rolling metal wire is characterized by being less than **0.2mm.
(6) The above (4) characterized by to carry out forced cooling of the molten metal of a metal bar-chart side within the air current of the cooling air which pulls up a metal wire, extracting the molten metal which adhered on the surface of the metal wire to predetermined thickness, and flows to abbreviation parallel just behind that in the travelling direction of a metal wire in the gas iris diaphragm section to which the deoxidization nature gas formed in the hot-dipping tub outlet is supplied, or the manufacture approach of a hot-dipping metal wire given in (5).
[0009] Others, aluminum, copper, etc. those alloys, etc. are mentioned to the metal which can be used for the metal wire of the core material of this invention. [iron / (mild steel special steel)] Moreover, zinc, aluminum, a zinc-aluminum alloy, etc. are mentioned as a metal which can be used for the molten-metal plating of this invention. Drawing 1 is drawing showing typically the

cross-section configuration [redacted] hot-dipping metal wire concerning t[redacted]vention, and explains the situation that the dimensional accuracy of the outer diameter of a hot-dipping metal wire is higher than the dimensional accuracy of the metal wire of a core material. In order for there to be a correlation in the dimensional accuracy of the metal wire of a core material, and the dimensional accuracy of the outer diameter of a hot-dipping metal wire and to set more dimensional accuracy of the outer diameter of a hot-dipping metal wire to **0.12mm at high degree of accuracy, it is desirable to set [in / for the dimensional accuracy of the metal wire of a core material / manufacture] dimensional accuracy of a hot rolling metal wire to less than **0.2mm. Moreover, although the cooling air used at a forced-air-cooling process although it changes also with various conditions, such as a class of plating metal, linear velocity at the time of plating, coating weight of plating, and a wire size, will not be especially limited if the molten metal adhering to the peripheral surface of a wire rod can be cooled from the perimeter by the equal pressure, its rate-of-flow 10 m/s - 60 m/s is common.

[0010] That is, if the rate of flow is less than 10 m/s, it will cause the lappet omission of an adhesion metal, and when it exceeds 60 m/s, there is a possibility of causing scattering of an adhesion metal. In addition, in a forced-air-cooling process, in order to heighten the cooling effect, water is mixed to air and it may be made to perform Myst cooling. Furthermore, although it changes also with various conditions, such as a class of plating metal, generally [the linear velocity at the time of plating, the coating weight of plating, and a wire size] for the linear velocity at the time of plating, the coating weight of 20-80m a part for /and plating is [100 - 800 g/m2 and a wire size] 2.0-10.0mm.

[0011] Moreover, although not limited, when nitrogen gas, hydrocarbon system gas, an exoergic mold controlled atmosphere, etc. are mentioned and a cost side is taken into consideration especially as deoxidization nature gas, an exoergic mold controlled atmosphere is desirable. An exoergic mold controlled atmosphere is a controlled atmosphere which the mixed gas which mixed town gas or natural gas, and air by excess air ratios fewer than a chemically correct mixture ratio is burned, and is obtained here, and it is desirable to use what absorbed moisture until especially the dew-point became -40 degrees C or less.

[0012]

[Embodiment of the Invention] The gestalt of operation of this invention is explained to it in detail, referring to a drawing to below. Drawing 2 is drawing which makes an example the case of a hot-dipping low carbon steel wire, and explains the gestalt of the operation about the manufacture approach of the hot-dipping metal wire concerning this invention.

[0013] As shown in drawing 2 , after this manufacture approach removes a surface scale by the mechanical descaler 22 which took over with the supply 11 and was prepared between opportunities 21 while it first pulls out precision rolling wire rod (it is hereafter described as "**** material") 1a beforehand hot-rolled by less than **0.2mm wire-size tolerance from a supply 11 and takes it over with the taking over machine 21, it extends the deflection of **** material 1a with a straightening machine 23. And after carrying out surface acid washing with the in-line pickling tank 24 prepared behind the taking over machine 21, a rinse tank 25 washes an acid and it pretreats through the flux tub 26 and a dryer 27 further.

[0014] Next, this pretreated wire rod 1b is made to come into the hot-dipping tub 3 equipped with the gas iris diaphragm section 4, as shown in drawing 2 and drawing 3 . After extracting molten metal by the deoxidization nature gas supplied to the gas iris diaphragm section 4, It cools with the forced-air-cooling equipment 5 and the water cooler 6 in which this non-solidified hot-dipping wire rod 1c was prepared by right above [of the gas iris diaphragm section 4], the metal of the melting condition of the front face of non-solidified hot-dipping wire rod 1c is solidified, and 1d of hot-dipping low carbon steel wires is obtained.

[0015] In addition, the gas iris diaphragm section 4 is supplied in the gas iris diaphragm section 4 from a gas supply line 41 by making into deoxidization nature gas what froze and absorbed moisture until a dew-point becomes -40 degrees C or less through a water-cooled process about the exoergic mold controlled atmosphere which the mixed gas which mixed town gas or natural gas, and air by excess air ratios fewer than a chemically correct mixture ratio is burned, and is obtained, as shown in drawing 3 . Moreover, forced-air-cooling equipment 5 is equipped

with the ventilator 52 connec[illegible] drawing 4] by flask-like the pressur[illegible]m 51 and this upper bed opening so that it might be shown, and while the container liner 53 which non-solidified hot-dipping wire rod 1c covered with the molten-metal layer along with the medial axis passes is installed through the pressure room 51, the application-of-pressure air supply tubing 54 is connected to the side face. Moreover, two or more straightening vanes 55 are formed in upper bed opening of the pressure room 51 between the container liner 53 and the peripheral wall at the radial.

[0016] That is, after the application-of-pressure air supplied in the pressure room 51 from the application-of-pressure air supply tubing 54 is rectified by the straightening vane 55, forced-air-cooling equipment 5 serves as an air current along the travelling direction of non-solidified hot-dipping wire rod 1c which moves through a ventilator 52 from a container liner 53, and is sent in in a ventilator 52.

[0017] On the other hand, a water cooler 6 pours water from the both sides of non-solidified hot-dipping wire rod 1c, cools further the molten-metal layer which air cooling was compulsorily carried out and was cooled to near the congealing point, and is made to solidify it thoroughly with forced-air-cooling equipment 5.

[0018] The manufacture approach of this hot-dipping low carbon steel wire by using **** material 1a by which precision strip processing was beforehand carried out to less than **0.2mm wire-size tolerance as feed line material as mentioned above Since pretreated wire rod 1b is obtained and it was made to perform hot dipping to this pretreated wire rod 1b, without passing through a wire-drawing process and an annealing process While wire-drawing equipment and annealing equipment become unnecessary and being able to reduce facility cost, wire-drawing power and an annealing fuel become unnecessary, and energy cost can be reduced. And the problem of the environmental pollution by the waste gas of the fuel used for a generation of electrical energy of wire-drawing power or heating at the time of annealing is also lost.

[0019] Moreover, forced-air-cooling equipment 5 is formed between the gas iris diaphragm section 4 and a water cooler 6. Since forced cooling of the non-solidified hot-dipping wire rod 1c to which the molten metal of this specified quantity adhered is carried out by forced-air-cooling equipment 5 immediately after the molten metal which adhered to the front face of pretreated wire rod 1b in the hot-dipping tub 3 is extracted to an amount predetermined in the gas iris diaphragm section 4 Without adhering molten metal hanging down and falling, where predetermined coating weight is secured, it moves till the place of a water cooler 6.

[0020] And with forced-cooling equipment 5, since the molten metal adhering to the front face of non-solidified hot-dipping wire rod 1c passes along the inside of the air current of cooling air parallel to the travelling direction of non-solidified hot-dipping wire rod 1c by the ventilator 52, air cooling is carried out, an equal pressure being added from a perimeter. That is, ****** of a product is improved by being cooled to near the congealing point, without molten metal's maintaining an abbreviation perfect circle condition, and having an appearance disturbed by the surface tension. Therefore, even if pretreatment settled wire rod 1b is the wire-size tolerance within **0.2mm, 1d of hot-dipping low carbon steel wires by which the wire-size tolerance of a product was covered with less than **0.12mm in the hot-dipping layer of the regular amount of plating can be obtained to accuracy.

[0021] The hot-dipping metal wire concerning this invention and its manufacture approach are not limited to the gestalt of the above-mentioned operation. For example, with the gestalt of the above-mentioned operation, although a wire-drawing process and an annealing process were not performed at all, annealing performs neither light wire drawing which is unnecessary extent, nor wire drawing, but may be made to perform only annealing if needed.

[0022] Moreover, although gas iris diaphragm equipment was used for the iris diaphragm section with the gestalt of the above-mentioned operation, it is clear that it is not what this invention extracts and limits a means to this.

[0023]

[Example] Below, the example of this invention is explained in more detail.

[0024] (Example) The 5.0mm10% aluminum-zinc alloy plating low carbon steel wire was manufactured by the same manufacture approach as the gestalt of the above-mentioned

implementation using the **** material of lot No.1-7, respectively. And [redacted]ng coating weight was measured with the maximum wire size of the upper bed section of each **** material and the obtained plating low carbon steel wire, and the soffit section, the minimum wire size, and the average wire size, and the result was shown in a table 1.

[0025]

[A table 1]

線材 No.		精圧線材径（mm）			製品径（偏径差 5.0±0.12mm）			付着量
		X	MIN.	MAX.	X	MIN.	MAX.	g／m²
1	上 下 X R	4.940 4.975 4.958 0.22	4.83 4.92	5.05 5.03	5.04 0.08	5.00	5.08	440
2	上 下 X R	4.905 4.98 4.943 0.23	4.80 4.93	5.03 5.01	5.05 0.08	5.01	5.09	410
3	上 下 X R	4.97 4.935 4.953 0.19	4.92 4.84	5.02 5.03	5.01 0.14	4.94	5.08	412
4	上 下 X R	4.915 4.93 4.92 0.39	4.72 4.83	5.11 5.03	5.03 0.12	4.97	5.09	421
5	上 下 X R	4.925 4.975 4.95 0.21	4.82 4.92	5.03 5.03	5.04 0.08	5.00	5.08	435
6	上 下 X R	4.95 4.945 4.948 0.16	4.87 4.88	5.03 5.01	5.05 0.08	5.01	5.09	452
7	上 下 X R	4.93 4.975 4.953 0.20	4.83 4.95	5.03 5.00	5.015 0.07	4.98	5.05	442
X	X R	4.946 0.229			5.034 0.093			

[0026] It turns out that ****** R of a product was halved from the above-mentioned table 1 with 0.093 to ****** R of feed line material having been 0.23, and the wire-size tolerance of product specification can be satisfied. That is, according to the manufacture approach of this invention, it turns out well that it is obtained without the thick-galvanized plating low carbon steel wire of the stable wire size performing wire drawing and annealing.

[0027]

[Effect of the Invention] Since the hot-dipping low carbon steel wire concerning this invention and its manufacture approach are constituted as mentioned above, they can skip a wire-drawing process and/or an annealing process, and can aim at simplification of a production line, and reduction of a manufacturing cost.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

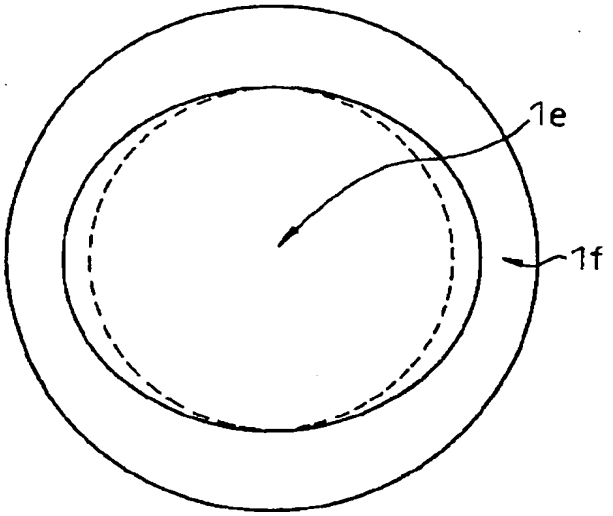
[Brief Description of the Drawings]
[Drawing 1] It is drawing showing typically the cross-section configuration of the hot-dipping metal wire concerning this invention.
[Drawing 2] It is the mimetic diagram which expressed typically the production line used for the manufacture approach of the hot-dipping low carbon steel wire concerning this invention.
[Drawing 3] They are the hot-dipping tub of drawing 2 , and the enlarged drawing of a cooling-system part.
[Drawing 4] It is the sectional view of forced-air-cooling equipment.
[Drawing 5] It is the production line used for the manufacture approach of the conventional hot-dipping low carbon steel wire, and is the mimetic diagram which expressed a part for the first portion typically.
[Drawing 6] It is the mimetic diagram which expressed typically the second half part of the second half partial manufacture approach of the production line of drawing 5 .
[Description of Notations]
1a -- Precision rolling wire rod
1b -- Pretreated wire rod
1c -- Non-solidified hot-dipping wire rod
1d -- Hot-dipping metal (iron) line
1e -- Core material (metal wire)
1f -- Hot-dipping layer
3 -- Hot-dipping tub
4 -- Gas iris diaphragm section
5 -- Forced-air-cooling equipment
6 -- Water cooler
11 -- Supply
21 -- Taking over machine
22 -- Mechanical descaler
23 -- Straightening machine
24 -- In-line pickling tank
25 -- Rinse tank
26 -- Flux tub
27 -- Dryer
41 -- Gas supply line
51 -- Pressure room
52 -- Ventilator
53 -- Container liner
54 -- Application-of-pressure air supply tubing
55 -- Straightening vane
100 -- Hot rolling (mild steel) wire rod
101 -- Batch type pickling tank
102 -- Wire drawing machine

103 -- Wire drawing wire rod
104 -- Annealing furnace
105 -- In-line pickling tank
106 -- Rinse tank
107 -- Flux tub
108 -- Dryer
109 -- Hot-dipping tub
110 -- Gas iris diaphragm section
111 -- Cooling section
112 -- Hot-dipping low carbon steel wire

[Translation done.]

Drawing selection [Representati[redacted]rawing]

図 1



[Translation done.]

JAPANESE [JP,11-32352[redacted]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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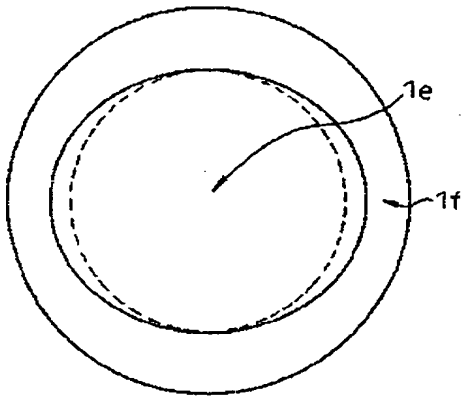
(71)出願人　000162962
興国鋼線索株式会社
京京都中央区八丁堀三丁目12番８号
(71)出願人　000006655
新日本製鐵株式会社
京京都千代田区大手町２丁目６番３号
(72)発明者　矢座　徹
大阪府貝塚市堤300番地　興国鋼線索株式会社内
(72)発明者　木津和　富夫
大阪府貝塚市堤300番地　興国鋼線索株式会社内
(74)代理人　弁理士　石田　敬　（外２名）

最終頁に続く

(54)【発明の名称】　溶融めっき金属線およびその製造方法

(57)【要約】
【課題】　伸線工程および／または焼鈍工程を省略することができて、伸線動力や焼鈍燃料が不要となり、大幅な省エネルギー効果を可能とし、生産ラインの簡略化や製造コストの低減を図ることができるとともに、伸線動力や焼鈍燃料が不要なことによって有害ガスの発生等を少なくして環境にも優しい画期的な溶融めっき金属線およびその製造方法を提供することを目的としている。
【解決手段】　芯材の金属線の周囲に溶融めっき層を有する溶融めっき金属線において、該溶融めっき金属線の外径の寸法精度が芯材の金属線の寸法精度より高いことを特徴とする溶融めっき金属線、および、熱間圧延金属線を、未伸線状態および／または未焼鈍状態でめっき前処理して、溶融めっきすることを特徴とする、前記溶融めっき金属線の製造方法。

図１



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【特許請求の範囲】

【請求項１】　芯材の金属線の周囲に溶融めっき層を有する溶融めっき金属線において、該溶融めっき金属線の外径の寸法精度が芯材の金属線の寸法精度より高いことを特徴とする溶融めっき金属線。

【請求項２】　前記芯材の金属線の寸法精度が、±０．２㎜以内であることを特徴とする請求項１に記載の溶融めっき金属線。

【請求項３】　前記溶融めっき金属線の外径の寸法精度が、±０．１２㎜以内であることを特徴とする請求項１または請求項２に記載の溶融めっき金属線。

【請求項４】　熱間圧延金属線を、未伸線状態および未焼鈍状態、または、それらのうちのいずれか一方の状態でめっき前処理して、溶融めっきすることを特徴とする請求項１ないし請求項３のいずれか１項に記載の溶融めっき金属線の製造方法。

【請求項５】　前記熱間圧延金属線の寸法精度が、±０．２㎜以内であることを特徴とする請求項４に記載の溶融めっき金属線の製造方法。

【請求項６】　溶融めっき槽出口に設けられた無酸化性ガスが供給されるガス絞り部で、金属線の表面に付着した溶融金属を所定の厚みに絞りつつ金属線を引き上げ、その直後に、金属線の進行方向に略平行に流れる冷却空気の気流内で、金属線表面の溶融金属を強制冷却することを特徴とする請求項４または請求項５に記載の溶融めっき金属線の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、溶融めっき金属線およびその製造方法に関するものである。

【０００２】

【従来の技術】耐食性を向上させるために、鉄線等の金属線の表面に亜鉛や亜鉛－アルミニウム合金等を溶融めっきした溶融めっき金属線が従来から各分野で使用されている。この溶融めっき金属線の従来法による製造工程を、溶融めっき鉄線の場合を例にして、図５、図６を用いて以下に説明する。まず、図５に示すように、熱間圧延された軟銅線材１００をバッチ式の酸洗槽１０１に浸漬して表面のスケールを除去したのち、一旦伸線機１０２に通し、所定の線径公差となるように伸線する。

【０００３】つぎに、図６に示すように、この伸線によって得られた伸線加工線材１０３を焼鈍炉１０４を通したのち、インライン酸洗槽１０５、水洗槽１０６、フラックス槽１０７、乾燥機１０８を通して前処理する。そして、前処理済の加工線材１０３を溶融めっき槽１０９に通して、加工線材１０３の周囲に溶融亜鉛を付着させたのち、絞り部１１０で余分な溶融金属を絞ったのち、冷却部１１１で冷却して溶融金属を固化させて溶融めっき鉄線１１２を製造するようになっている。

【０００４】このようにして製造される溶融めっき鉄線

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のうち、たとえば、ＪＩＳ　Ｇ　３５４７のφ５．０㎜の亜鉛めっき鉄線ＳＷＭＧＳ－Ｇ７（付着量４００ｇ／ｍ²以上）は、最終製品の線径の規格許容差が±０．１２㎜に規定されている。また、通常このような亜鉛めっき鉄線の原料線材として使用されているＪＩＳＧ　３５０５（１９９６）の軟銅線材は、線径公差が±０．４㎜で偏径差が０．６４㎜以下と規定されている。また、ＪＩＳ　Ｇ　３５３２では、ＪＩＳ　Ｇ　３５０５に適合した軟銅線材を伸線または冷間圧延して製造する鉄線に対して、寸法精度を製品径３．２０㎜を越え６．００㎜以下の場合±０．０８㎜以内、製品径６．００㎜を越える場合±０．１０㎜以内と規定されている。

【０００５】したがって、ＪＩＳ　Ｇ　３５０５の軟銅線材をそのまま使用して亜鉛めっきしたのでは、最終の亜鉛めっき鉄線の線径公差を規格線径公差の±０．１２㎜にすることが難しく、めっき金属線の製造工程には、熱間圧延金属線の伸線等の冷間加工および／またはそれに伴う加工硬化を元に戻すための焼鈍処理が不可欠なものと考えられてきた。上述の例では、軟銅線材を製品規格の線径公差近辺になるように伸線するとともに、この伸線によって得られた伸線加工線材１０３を焼鈍炉１０４を通して焼鈍し伸線加工による加工硬化を元に戻したのち、インライン酸洗槽１０１、水洗槽１０６、フラックス槽１０７、乾燥機１０８を通して前処理するようにしている。

【０００６】

【発明が解決しようとする課題】しかし、亜鉛めっき金属線の用途によっては、熱間圧延された金属線材にめっき前処理のみを施してそのままめっきを行っても、引っ張り強さ、伸び率％、ねじり特性等の機械的性質が十分に満足なものを得ることができる場合も多い。したがって、このような場合は、伸線および焼鈍の実施は、めっき設備以外に、伸線装置や焼鈍炉が必要であるとともに、伸線工程における線材の処理速度が大きく、焼鈍工程での線材の処理速度とが大きく違うため、焼鈍工程と、めっき工程とを１ラインにしたとしても、伸線工程は、別のラインに分けなければならないため、設備コストがかかりすぎるとともに、製造工程が煩雑であり、伸線電力、焼鈍燃料と多くのエネルギーを使用すると言う問題がある。

【０００７】そこで、本発明は、このような事情に鑑みて、伸線工程および／または焼鈍工程を省略することができて、伸線電力や焼鈍燃料が不要となり、大幅な省エネルギー効果を可能とし、生産ラインの簡略化や製造コストの低減を図ることができるとともに、伸線電力や焼鈍燃料が不要なことによって有害ガスの発生等を少なくして環境にも優しい画期的な溶融めっき金属線およびその製造方法を提供することを目的としている。

【０００８】

【課題を解決するための手段】本発明者らは、上記問題

を解決するために、鋭意検討した結果、溶融めっき金属線の使用性能に及ぼす寸法精度としては、溶融めっき金属線の外径の寸法精度が重要であり、芯材の金属線の寸法精度は必ずしも高い必要はないことを新たに知見した。さらに、芯材の金属線の寸法精度にかかわらず、溶融めっき精直後に特殊な強制冷却法を実施すれば、溶融めっき層による真円度の改善効果があることも新たに知見した。本発明は、上記の新知見に基づいて完成したものであり、その要旨は、下記の通りである。

（１）芯材の金属線の周囲に溶融めっき層を有する溶融めっき金属線において、該溶融めっき金属線の外径の寸法精度が芯材の金属線の寸法精度より高いことを特徴とする溶融めっき金属線。

（２）前記芯材の金属線の寸法精度が、±０．２㎜以内であることを特徴とする上記（１）に記載の溶融めっき金属線。

（３）前記溶融めっき金属線の外径の寸法精度が、±０．１２㎜以内であることを特徴とする上記（１）または（２）に記載の溶融めっき金属線。

（４）熱間圧延金属線を、未伸線状態および未焼鈍状態、または、それらのうちのいずれか一方の状態でめっき前処理して、溶融めっきすることを特徴とする上記（１）ないし（３）のいずれか１項に記載の溶融めっき金属線の製造方法。

（５）前記熱間圧延金属線の寸法精度が、±０．２㎜以内であることを特徴とする上記（４）に記載の溶融めっき金属線の製造方法。

（６）溶融めっき槽出口に設けられた無酸化性ガスが供給されるガス搾り部で、金属線の表面に付着した溶融金属を所定の厚みに搾りつつ金属線を引き上げ、その直後に、金属線の進行方向に略平行に流れる冷却空気の気流内で、金属線表面の溶融金属を強制冷却することを特徴とする上記（４）または（５）に記載の溶融めっき金属線の製造方法。

【０００９】本発明の芯材の金属線に使用できる金属には、鉄（軟鋼、特殊鋼）の他、アルミニウム、銅などやそれらの合金などが挙げられる。また、本発明の溶融金属めっきに使用できる金属としては、亜鉛、アルミニウム、亜鉛－アルミニウム合金などが挙げられる。図１は、本発明にかかる溶融めっき金属線の断面形状を模式的に示す図であり、溶融めっき金属線の外径の寸法精度が芯材の金属線の寸法精度より高い状況を説明している。芯材の金属線の寸法精度と溶融めっき金属線の外径の寸法精度には相関関係があり、溶融めっき金属線の外径の寸法精度をより高精度に、例えば±０．１２㎜にするためには、芯材の金属線の寸法精度を、製造にあたっては熱間圧延金属線の寸法精度を±０．２㎜以内とするのが望ましい。また、めっき金属の種類、めっき時の線速、めっきの付着量、線径等の各種条件によっても異なるが、強制空冷工程で使用される冷却空気は、線材の周

面に付着した溶融金属を均等な圧力で全周から冷却できれば、特に限定されないが、流速１０ｍ／ｓ～６０ｍ／ｓが一般的である。

【００１０】すなわち、流速が、１０ｍ／ｓを下回ると、付着金属の垂れ落ちを招き、６０ｍ／ｓを上回ると、付着金属の飛散を招く恐れがある。なお、強制空冷工程において、冷却効果を高めるため、空気に水を混合し、ミスト冷却を行うようにしてもよい。さらに、めっき金属の種類等の各種条件によっても異なるが、めっき時の線速、めっきの付着量、線径は、一般的に、めっき時の線速が２０～８０ｍ／分、めっきの付着量が１００～８００ｇ／ｍ²、線径が２．０～１０．０㎜である。

【００１１】また、無酸化性ガスとしては、特に限定されないが、窒素ガス、炭化水素系ガス、発熱型雰囲気ガス等が挙げられ、コスト面を考慮すると、発熱型雰囲気ガスが好ましい。ここで、発熱型雰囲気ガスとは、都市ガスあるいは天然ガスと、空気とを理論混合比よりも少ない空気比で混合した混合ガスを燃焼させて得られる雰囲気ガスであって、特に露点が－４０℃以下になるまで吸湿したものを用いることが好ましい。

【００１２】

【発明の実施の形態】以下に、本発明の実施の形態を、図面を参照しつつ詳しく説明する。図２は、本発明にかかる溶融めっき金属線の製造方法について、溶融めっき鉄線の場合を例にして、その実施の形態を説明する図である。

【００１３】図２に示すように、この製造方法は、まず、±０．２㎜以内の線径公差に予め熱間圧延された精密圧延線材（以下、「精圧材」と記す）１ａをサプライ１１から引き出し、引取り機２１によって引き取るとともに、サプライ１１と引取り機２１との間に設けられたメカニカルデスケーラー２２によって表面のスケールを除去したのち、直線機２３で精圧材１ａの曲がりを延ばす。そして、引取り機２１の後方に設けられたインライン酸洗槽２４で表面酸洗したのち、水洗槽２５で酸を洗浄し、さらに、フラックス槽２６および乾燥機２７を通して前処理を行う。

【００１４】つぎに、図２および図３に示すように、この前処理済線材１ｂをガス搾り部４を備えた溶融めっき槽３に入線させ、ガス搾り部４に供給された無酸化性ガスによって溶融金属を搾ったのち、この未固化溶融めっき線材１ｃをガス搾り部４の直上に設けられた強制空冷装置５および水冷装置６によって冷却して未固化溶融めっき線材１ｃの表面の溶融状態の金属を固化させて溶融めっき鉄線１ｄを得るようになっている。

【００１５】なお、ガス搾り部４は、図３に示すように、都市ガスあるいは天然ガスと、空気とを理論混合比よりも少ない空気比で混合した混合ガスを燃焼させて得られる発熱型雰囲気ガスを水冷工程を経て露点が－４０℃以下になるまで冷凍して吸湿したものを無酸化性ガス

としてガス供給管４１からガス搾り部４内に供給するようになっている。また、強制空冷装置５は、図４に示すように、フラスコ状の圧力室５１と、この上端開口部に連接された通風筒５２とを備え、圧力室５１には中心部に沿って溶融金属層で被覆された未固化溶融めっき鋼材１ｃが通過する内筒５３が貫設されているとともに、側面に加圧空気供給管５４が接続されている。また、圧力室５１の上端開口部には、内筒５３と外周壁との間に放射状に複数の整流板５５が設けられている。

【００１６】すなわち、強制空冷装置５は、加圧空気供給管５４から圧力室５１内に供給された加圧空気が整流板５５で整流されたのち、内筒５３から通風筒５２を通って移動する未固化溶融めっき鋼材１ｃの進行方向に沿った気流となって通風筒５２内に送り込まれるようになっている。

【００１７】一方、水冷装置６は、未固化溶融めっき鋼材１ｃの両側から水をかけて強制空冷装置５によって強制的に空冷されて凝固点近くまで冷却された溶融金属層をさらに冷却し完全に固化させるようになっている。

【００１８】この溶融めっき鉄線の製造方法は、上記のように、原料線材として±０．２㎜以内の線径公差に予め精密圧延加工された精圧材１ａを用いることによって、伸線工程および焼鈍工程を経ることなく前処理済線材１ｂが得られ、この前処理済線材１ｂに溶融めっきを施すようにしたので、伸線装置および焼鈍装置が不要になり、設備コストが低減できるとともに、伸線電力および焼鈍燃料が不要となり、エネルギーコストが削減できる。しかも、伸線電力の発電や焼鈍時の加熱に使用される燃料の廃ガスによる環境汚染の問題も無くなる。

【００１９】また、ガス搾り部４と水冷装置６との間に強制空冷装置５が設けられ、溶融めっき槽３で前処理済線材１ｂの表面に付着した溶融金属層がガス搾り部４で所定の量に搾られたのち、この所定量の溶融金属層が付着した未固化溶融めっき鋼材１ｃが強制空冷装置５によって直ちに強制冷却されるので、付着した溶融金属層が垂れ落ちることなく所定の付着量を確保した状態で、水冷装置６のところまで移動する。

【００２０】しかも、強制冷却装置５では、未固化溶融めっき鋼材１ｃの表面に付着した溶融金属層が、通風筒５２で未固化溶融めっき鋼材１ｃの進行方向と平行な冷却空気の気流内を通るため、周囲から均等な圧力が加わりつつ空冷される。すなわち、溶融金属層がその表面張力によって略真円状態を保ち外形を乱されることなく、凝固点付近まで冷却されることによって、製品の偏径差が改善される。したがって、前処理済鋼材１ｂが±０．２㎜以内の線径公差であっても、製品の線径公差が±０．１２㎜以内で規定のめっき量の溶融めっき層で被覆された溶融めっき鉄線１ｄを正確に得ることができる。

【００２１】本発明にかかる溶融めっき金属線およびその製造方法は、上記の実施の形態に限定されない。たとえば、上記の実施の形態では、伸線工程および焼鈍工程をまったく行わなかったが、焼鈍が不要な程度の軽い伸線や、伸線を行わず、焼鈍のみを必要に応じて行うようにしても構わない。

【００２２】また、上記の実施の形態では、搾り部にガス搾り装置を使用していたが、本発明が搾り手段をこれに限定するものではないことは明らかである。

【００２３】

【実施例】以下に、本発明の実施例をより詳しく説明する。

【００２４】（実施例）ロットＮｏ．１～７の精圧材を用い、上記実施の形態と同様の製造方法で、５．０㎜１０％アルミニウム－亜鉛合金めっき鉄線をそれぞれ製造した。そして、各精圧材および得られためっき鉄線の上端部および下端部の最大線径、最小線径および平均線径と、めっき付着量を測定し、その結果を表１に示した。

【００２５】

【表１】

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線材No.		被圧線材径（mm）			製品径（線径差 5.0±0.12mm）			付着量
		X	MIN.	MAX.	X	MIN.	MAX.	g／m²
1	上 下 X R	4.940 4.975 4.958 0.32	4.83 4.92	5.05 5.03	5.04 0.08	5.00	5.08	440
2	上 下 X R	4.905 4.98 4.943 0.23	4.80 4.93	5.03 5.01	5.05 0.08	5.01	5.09	410
3	上 下 X R	4.97 4.935 4.953 0.19	4.92 4.84	5.02 5.03	5.01 0.14	4.94	5.08	412
4	上 下 X R	4.915 4.99 4.92 0.36	4.72 4.83	5.11 5.03	5.03 0.12	4.97	5.09	421
5	上 下 X R	4.925 4.975 4.95 0.21	4.82 4.92	5.03 5.03	5.01 0.08	5.00	5.08	435
6	上 下 X R	4.95 4.945 4.948 0.16	4.87 4.88	5.03 5.01	5.05 0.08	5.01	5.09	452
7	上 下 X R	4.93 4.975 4.953 0.20	4.88 4.95	5.03 5.00	5.015 0.07	4.98	5.05	442
X	X R	4.946 0.229			5.034 0.095			

【００２６】上記表１から原料線材の偏径差Rが０．２３であったのに対し、製品の偏径差Rが０．０９３と半減し、製品規格の線径公差が満足できていることがわかる。すなわち、本発明の製造方法によれば、厚めっきされた安定した線径のめっき鉄線が伸線や焼鈍を行うことなく得られることがよくわかる。

【００２７】

【発明の効果】本発明にかかる溶融めっき鉄線およびその製造方法は、以上のように構成されているので、伸線工程および／または焼鈍工程を省略することができ、生産ラインの簡略化や製造コストの低減を図ることができる。

【図面の簡単な説明】

【図１】本発明にかかる溶融めっき金属線の断面形状を模式的に示す図である。

【図２】本発明にかかる溶融めっき鉄線の製造方法に使用する製造ラインを模式的にあらわした模式図である。

【図３】図２の溶融めっき槽および冷却装置部分の拡大図である。

【図４】強制空冷装置の断面図である。

【図５】従来の溶融めっき鉄線の製造方法に使用する製造ラインであって、その前半部分を模式的にあらわした模式図である。

【図６】図５の製造ラインの後半部分製造方法の後半部分を模式的にあらわした模式図である。

【符号の説明】

１ａ…精密圧延線材
１ｂ…前処理済線材
１ｃ…未固化溶融めっき線材
１ｄ…溶融めっき金属（鉄）線
１ｅ…芯材（金属線）
１ｆ…溶融めっき層
３…溶融めっき槽
４…ガス絞り部
５…強制空冷装置
６…水冷装置
１１…サプライ
２１…引取り機
２２…メカニカルデスケーラー
２３…直線機
２４…インライン酸洗槽
２５…水洗槽
２６…フラックス槽
２７…乾燥機
４１…ガス供給管
５１…圧力室

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５２…通風筒
５３…内筒
５４…加圧空気供給管
５５…整流板
１００…熱間圧延（軟鋼）線材
１０１…バッチ式酸洗槽
１０２…伸線機
１０３…伸線加工線材
１０４…焼鈍炉

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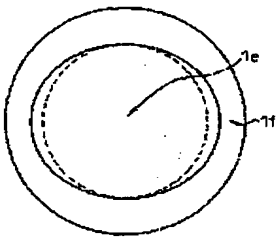
＊１０５…インライン酸洗槽
１０６…水洗槽
１０７…フラックス槽
１０８…乾燥機
１０９…溶融めっき槽
１１０…ガス絞り部
１１１…冷却部
１１２…溶融めっき鉄線
＊

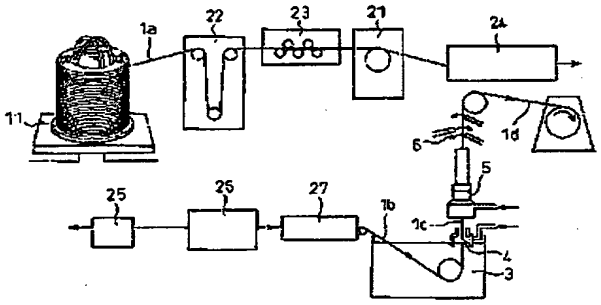
【図１】

図１



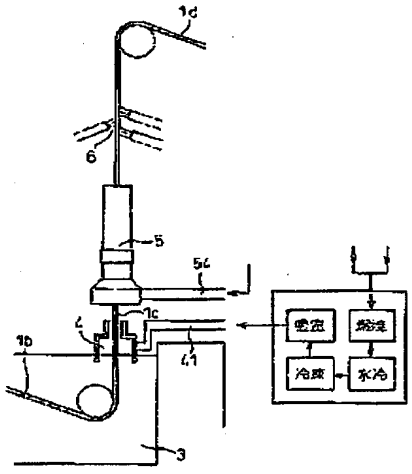
【図２】

図２



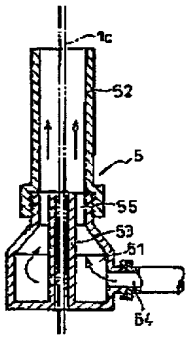
【図３】

図３



【図４】

図４



9

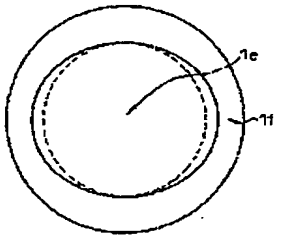
５２…通風筒
５３…内筒
５４…加圧空気供給管
５５…整流板
１００…熱間圧延（軟鋼）線材
１０１…バッチ式酸洗槽
１０２…伸線機
１０３…伸線加工線材
１０４…焼鈍炉

10

＊１０５…インライン酸洗槽
１０６…水洗槽
１０７…フラックス槽
１０８…乾燥機
１０９…溶融めっき槽
１１０…ガス拭き部
１１１…冷却部
１１２…溶融めっき鉄線
＊

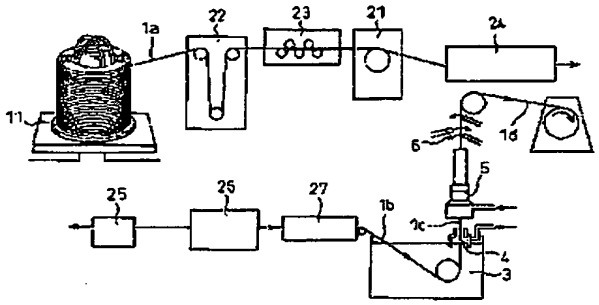
【図１】

図１



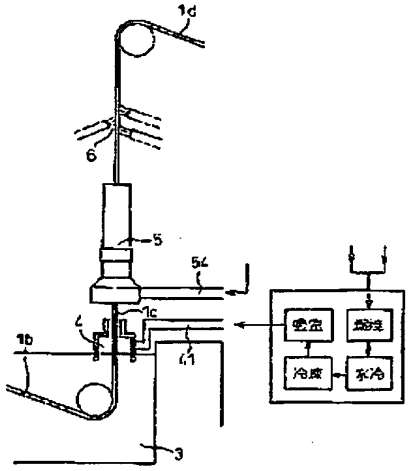
【図２】

図２



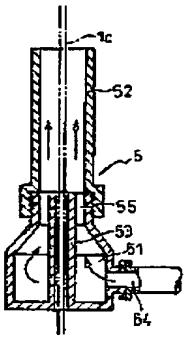
【図３】

図３

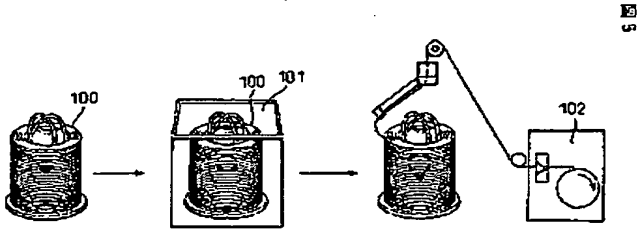


【図４】

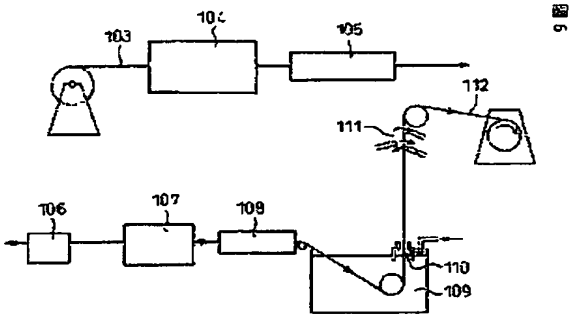
図４



【図5】



【図6】



フロントページの続き

(72)発明者　佐々木　佳行
岩手県釜石市鈴子町23-15　新日本製鐵株式会社釜石製鐵所内

(72)発明者　児玉　順一
岩手県釜石市鈴子町23-15　新日本製鐵株式会社釜石製鐵所内

(72)発明者　大津　芳久
岩手県釜石市鈴子町23-15　新日本製鐵株式会社釜石製鐵所内

(72)発明者　荒巻　広美
岩手県釜石市鈴子町23-15　新日本製鐵株式会社釜石製鐵所内